

To: Examiner of the Patent Office

1. Identification of the International Application

PCT/JP2004/013714

2. Applicant

Name: Kureha Chemical Industry Company, Limited

Address: 9-11, Nihonbashi Horidome-cho 1-chome, Chuo-ku,
Tokyo 103-8552 JAPAN

Country of nationality: Japan

Country of residence : Japan

3. Agent

Name: (7875) Patent Attorney OHI Masahiko

Address: Nissenren-Asahiseimei Building, 4, Kanda Surugadai
3-chome, Chiyoda-ku, Tokyo 101-0062 Japan

4. Date of Notification: 28. 12. 2004

5. Subject Matter of Reply:

[1] Abstract of an Opinion by the International Searching Authority

In the opinion by the International Searching Authority of 28th
December 2004, the Examiner, Esq. found that

"1. Opinion:

Novelty (N)	Claims _____	Involved
	Claims <u>1-15</u>	Not involved
Inventive Step (IS)	Claims _____	Involved
	Claims <u>1-15</u>	Not involved
Industrial Applicability (IA)	Claims <u>1-15</u>	Involved
	Claims _____	Not involved

2. References and Description:

<Claims 1 to 4, 7, 8 and 11 to 13 / Reference 1>

In Reference 1, there is mentioned a near infrared-absorbing material (claim 1 and 2, [0007] [0015]) containing, a copper (II) containing phosphoric acid compound, and a transition metal component or an alkali earth metal component such as magnesium or calcium, a resin composition (claim 3, [0016]) containing, the near infrared-absorbing material, an application use of the metal component in a form of salt ([0008]), and, production example ([0021]-[0026]) of the near infrared-absorbing material comprising the copper (II) containing phosphoric acid compound and calcium carbonate.

From the description in Reference 1, although it is not suggested that the metal component in the near infrared-absorbing material of Reference 1 is "the anti-blackening agent", the infrared-absorbing composition of the invention of the present application and the near infrared-absorbing material mentioned in Reference 1 are identical in their structural components, and the metal component in Reference 1 is also recognized to have as a matter of fact a property as the anti-blackening agent, therefore, the both are the same inventions as products.

<Claims 1 to 15 / Reference 2>

In Reference 2, there is mentioned that to achieve desired light absorbing property by using the infrared-absorbing component comprising the divalent copper ion and alkyl phosphate, a layer of polyvinyl butyral resin containing the infrared-absorbing component, and, other metal ion such as sodium, potassium, calcium, manganese etc. than the copper ion, in combination (claims 1 to 7, [0016]-[0024]).

From the description in Reference 2, although it is not suggested that the above-mentioned other metal ion is "the anti-blackening agent", the infrared-absorbing composition of the invention of the present application and the infrared-absorbing component mentioned in Reference 2 are identical in their structural components, and the other metal ion in Reference 1 is also recognized to have as a matter of fact a property as the anti-blackening agent, therefore, the both are the same invention as products.

Reference 1 : JP 6-207161 A (Asahi Glass Co. Ltd.) 1994.07.26

Reference 2 : JP 9-211220 A (Kureha Chemical Industry Company, Limited) 1997.08.15

References 1 and 2 are recited in the International Search Report."

[2] Description of the Invention of the Present Application

(1) Subject-matter of the Invention of the Present Application:

The description of the claims of the present application has been amended in the following manner by the amendment submitted on the same day as this reply.

"1. An infrared-absorbing composition comprising an infrared absorbent composed of a divalent ionic copper compound and an anti-blackening agent composed of a metal salt compound for preventing a blackening phenomenon due to the infrared absorbent,

wherein, the divalent ionic copper compound composing the infrared absorbent is a phosphorus-containing copper compound of a phosphorus compound selected from phosphate compounds, phosphonic acid compounds, phosphonate compounds, and phosphinic acid compounds, and

wherein, the metal salt compound composing the anti-blackening agent is a compound of lithium, sodium, potassium, cesium, magnesium, or manganese.

2.

3.

4.

5. The infrared-absorbing composition according to claim 1, wherein a phosphorus compound is an alkyl phosphate.

6. The infrared-absorbing composition according to claim 5, wherein the alkyl phosphate is a compound the alkyl group of which has 4 to 18 carbon atoms.

7. An infrared-absorbing resin composition comprising an infrared absorbent composed of a divalent ionic copper compound and an anti-blackening agent composed of a metal salt compound for preventing a blackening phenomenon due to the infrared absorbent, which are contained in a resin component,

wherein, the divalent ionic copper compound composing the infrared absorbent is a phosphorus-containing copper compound of a phosphorus compound selected from phosphate compounds, phosphonic acid compounds, phosphonate compounds, and phosphinic acid compounds, and

wherein, the metal salt compound composing the anti-blackening agent is a compound of lithium, sodium, potassium, cesium, magnesium, or

manganese.

8. The infrared-absorbing resin composition according to claim 7, wherein a proportion of the infrared absorbent is 0.1 to 45 parts by mass per 100 parts by mass of the resin component, and a proportion of the anti-blackening agent is 0.01 to 200 % by mass based on a divalent copper ion in the infrared absorbent.

9. The infrared-absorbing resin composition according to claim 7 or 8, wherein the resin component comprises a resin having an acetal structure.

10. The infrared-absorbing resin composition according to claim 7 or 8, wherein the resin component comprises a polyvinyl acetal resin.

11.

12.

13.

14. The infrared-absorbing resin composition according to any one of claims 7 to 10, wherein a phosphorus compound is an alkyl phosphate.

15. The infrared-absorbing resin composition according to claim 14, wherein the alkyl phosphate is a compound the alkyl group of which has 4 to 18 carbon atoms."

(2) Description of the Amendment:

<1> In description page 35, line 25, "infrared absorbent" is amended to "anti-blackening agent". This amendment is to correct a miss-type.

<2> In claim 1 in claims page 40, following amendments are made.

(i) It is set forth that in the anti-blackening agent, a metal salt compound composing thereof is a compound of a specific metal, i.e. "a compound of lithium, sodium, potassium, cesium, magnesium or manganese".

The matter is mentioned in claim 3 in claims page 40. However, "calcium" was deleted.

(ii) It is set forth that in the infrared absorbent, a divalent ionic copper compound composing thereof is a phosphorus-containing copper compound comprising a specific phosphorus compound, i.e. those "selected from phosphate compounds, phosphonic acid compounds, phosphonate compounds and phosphinic acid compounds".

The matter is mentioned in description page 10, lines 21 to 26.

<3> With the amendment referred to the above item <2>, claim 2 to 4 in claims page 40 are deleted.

<4> In claim 5 in claims page 40, "a phosphorus compound contained in the phosphorus-containing copper compound" is amended to "a

phosphorus compound". This amendment is to clarify an unclear description. The claim number referred to in claims is changed at the same time.

<5> Claim 6 in claims page 41 is not changed.

<6> In claim 7 in claims page 41, the same amendment was made as in the above item <2>.

<7> With the amendment made in the above item <6>, claim 11 in claims page 41 and 42, claim 12 and 13 in claims page 42 are deleted.

<8> Claims 8 to 10 in claims page 41 are not changed.

<9> In claim 14 in claims page 42, the same amendment was made as in the above item <4>.

<10> Claim 15 in claims page 42 is not changed.

(3) Effects of the inventions of the present application

According to the infrared-absorbing composition of the invention of the present application, an excellent infrared-absorbing property is exhibited by the divalent copper ion, and at the same time, an occurrence of the blackening phenomenon is prevented even when ultra violet rays are irradiated over a long period of time, by containing the anti-blackening agent composed of the metal salt compound of the specific metal, thereby, there is provided an effect that the excellent infrared-absorbing property is stably retained over a long period of time.

Further, according to the infrared-absorbing resin composition of the invention of the present application, an excellent infrared-absorbing property is exhibited by the divalent copper ion, and at the same time, the occurrence of the blackening phenomenon is prevented even when ultra violet rays are irradiated over a long period of time, by containing the anti-blackening agent composed of the metal salt compound of the specific metal, thereby, there is provided an effect that the excellent visible ray transmitting property and infrared-absorbing property are stably retained over a long period of time.

[3] Description of the cited References:

In Japanese Patent Application Laid-Open No. 6-207161, which is Reference 1, there is described that a metal component selected from cobalt component, neodymium component, erbium component, magnesium component, calcium component, strontium component and barium component is contained in a infrared absorbent composed of a phosphorus-containing copper compound.

In Japanese Patent Application Laid-Open No. 9-211220, which is Reference 2, there is described that in an infrared-absorbing body containing a divalent copper ion and a phosphoric acid group containing compound in a resin component, there may further be contained other metal ion such as sodium ion, potassium ion, neodymium ion etc.

[4] Comparison between inventions of present application and inventions mentioned in References

(1) Comparison between invention according to claim 1 and inventions mentioned in References

<1> Comparison with invention mentioned in Reference 1

The invention according to claim 1 of the present application is compared with the invention mentioned in Reference 1. The both inventions agree in a point that the other metal salt compound is contained in the infrared absorbent together with the divalent copper ion and a phosphoric acid group.

On the other hand, they differ in: a point that, in the invention of the present application, it is set forth that the phosphoric acid group contained is that of the specific phosphorus compound, whereas, in Reference 1, such a matter is not specifically described, and; a point that, in the invention of the present application, it is set forth that the anti-blackening agent composed of the specific metal salt compound is contained, whereas, in Reference 1, such a matter is not specifically described.

Specifically described, in the invention of the present application, the phosphoric acid group comprises "the phosphorus compound selected from phosphate compounds, phosphonic acid compounds, phosphonate compounds and phosphinic acid compounds", whereas in Reference 1, there is no description about such a kind of the phosphorus compound at all.

Further, in the invention of the present application, the metal salt compound composing the anti-blackening agent is the compound of the specific metal, i.e. "the compound of lithium, sodium, potassium, cesium, magnesium or manganese", whereas in the invention in Reference 1, there is no description about such a kind of the metal component at all.

According to the invention of the present application, there is provided the effect that the occurrence of the blackening phenomenon is prevented even when ultra violet rays are irradiated over a long period

of time, whilst achieving the excellent infrared-absorbing property by the copper ion, and therefore, the excellent infrared-absorbing property is stably retained over a long period of time. However, such effect is not also mentioned in Reference 1.

<2> Comparison with invention mentioned in Reference 2

(i) The invention according to claim 1 of the present application is compared with the invention mentioned in Reference 2. The both inventions agree in: a point that the infrared-absorbing body is composed by containing the divalent copper ion and the phosphoric acid group in the resin component, and; a point that the other ionic metal compound than copper ion is contained.

On the other hand, they differ in a point that, in the invention of the present application, it is set forth that the other ionic metal compound than the copper ion is the anti-blackening agent composed of the specific metal salt compound, whereas in Reference 2, such a matter is not specifically mentioned.

(ii) The above difference is explained. In the invention of the present application, the metal salt compound composing the anti-blackening agent is the specific metal salt compound, which is "the compound of lithium, sodium, potassium, cesium, magnesium or manganese", and it is proved by the examples (refer to Table 1 in description, page 38) that these compounds actually provide the effect as the anti-blackening agent.

On the other hand, in Reference 2, there are exemplified "sodium ion, potassium ion, zinc ion, iron ion, nickel ion, chromium ion, cobalt ion, vanadium ion, manganese ion, neodymium ion, holmium ion" as a metal ion to be contained in the resin component together with the copper ion. However, such metal ion is contained for utilizing the light absorbing-property of itself, as clearly understood from a description "by using ion of such other metal, light absorbing property is provided according to the ion of other metal." at the end of paragraph 0017 in Reference 2.

Namely, in the invention in Reference 2, there is only suggested that the other metal ion may be co-existed with the divalent copper ion, and suggested that, in such a case, the light absorbing-property by the other metal ion should be obtained together with the infrared-absorbing property by the divalent copper ion.

On the other hand, the invention of the present application is

completed by: finding out a practical technical problem of the divalent ionic copper compound that the blackening phenomenon occurs when ultra violet rays are irradiated over a long period of time in the system containing the divalent ionic copper compound exhibiting the infrared-absorbing property, and finding that the problem can be solved by co-existing the specific metal salt compound as a result of a series of various researches for solving the novel technical problem to be solved.

Namely, in the system that the divalent copper ion is contained with the specific phosphoric acid group, the excellent infrared-absorbing property may be obtained, although such system will experience the occurrence of the blackening phenomenon by the irradiation of ultra violet rays over a long period of time. Present invention, however, utilizes a fact that a unique phenomenon that the blackening phenomenon is prevented by the specific metal salt compound, thereby solving the marked problem for utilizing infrared-absorbing property by the divalent copper ion. Therefore, in this regard, the effect of the invention of the present application is exceptionally remarkable.

(iii) On the other hand, a metal salt compound of neodymium, for example, referred to as other metal ion in Reference 2 is not capable of preventing the blackening phenomenon, and the effect of the invention of the present application is not provided. This is also clear from the result of the following comparative experiment.

[Comparative Experiment]

I. Experiment was carried out as follows:

Term 2003.09.01 to 2003.09.10

Venue Nishiki Reserch Laboratories, Kureha Chemical Industry Company, Limited

16 Ochiai, Nishiki-machi, Iwaki, Fukushima Japan

Person in charge

Address: 1-6, Ochiai, Nishiki-machi, Iwaki, Fukushima

Name: Rumi Ueda

(Duty in Nishiki Reserch Laboratories, Kureha Chemical Industry, Limited)

Main technical area in charge: development of optical resin filter techniques

II. Object of Experiment

Conducting the same operations and evaluations as in the examples

and the experimental examples by using neodymium acetate as the metal salt compound.

III. Process of Experiment

(a) Preparation of Copper Ion Containing Compound

Into a solution obtained by dissolving 5.00 g of a phosphorus compound (product of Tokyo Kasei Kogyo Co., Ltd.) composed of an equimolar mixture of mono(2-ethylhexyl) phosphate and di(2-ethylhexyl) phosphate in 15 g of toluene, was added 2.37 g of copper acetate monohydrate, and acetic acid was removed by refluxing the solution. Further, toluene was distilled off from the thus obtained reaction solution, to obtain 6.04 g of a phosphate copper compound.

(b) Production of infrared-absorbing resin composition sheet body

A polyvinyl butyral resin "S-LEC BM-1" (product of Sekisui chemical Co., Ltd.) as a resin material, a phosphate copper compound obtained in the above item (a) as an infrared absorbent, and, neodymium acetate monohydrate as a metal salt compound and triethylene glycol bis-2-ethylhexanoic acid were provided.

Into a solution obtained by dissolving, 1.2 g of the infrared absorbent and 0.02 g of the metal salt compound in 2.4 g of plasticizer, was added 8.4 g of the resin material. The resultant mixture was subjected to a pressing treatment for 3 times at 85°C by means of a pressing machine "WF-50" (product of Shinto Metal Industries, Ltd.), and further to the pressing treatment for 3 times at 120 °C to conduct kneading and forming, thereby producing an infrared-absorbing resin composition sheet body of 1 mm thickness.

(C) Production of Laminated Glass

The infrared-absorbing resin composition sheet body obtained in the above item (b) was placed between 2 plates of slide glass each having length of 26 mm, width of 76 mm and thickness of 1 mm. This laminate was subjected to a bonding treatment under pressure for 30 minutes by using an autoclave under conditions of a temperature of 130°C and a pressure of 1.2 Mpa, thereby producing a laminated glass. This laminated glass is referred to as "Comparative sample X".

(d) Irradiation of Ultra Violet rays

By means of a xenon weatherometer "Atlas C135" (manufactured by Toyo Seiki Seisaku-Sho, Ltd.) equipped with a xenon arc discharge lamp of electric power consumption of 7.5 kW, above comparative sample X was irradiated with light containing ultra violet rays over 100 hours under

condition of energy intensity of 0.85 W/m^2 .

IV. Evaluation

After irradiation of ultra violet rays, the Comparative sample X was visually observed. As a result, a great number of fine black particulate spots were occurred, and so the blackening phenomenon was observed.

Further, as to Comparative sample X, visible ray transmittance measured before and after irradiation of ultra violet rays, and, rates of change in visible ray transmittance by the irradiation of the ultra violet rays were determined. The measurements were made by means of spectrophotometer "U-4000" (manufactured by Hitachi, Ltd.), in accordance with Japan Industrial Standard (JIS) R3106. The results are shown in the following table A.

Table A

Sample	Infrared Absorbent (1.2 g)	Metal Salt Compound		Visible Ray Transmittance (%)		Change by Irradiation of Ultra Violet Rays (%)
	Kind	Kind	Amount (g)	Before Irradiation of Ultra Violet rays	After Irradiation of Ultra Violet rays	
comparative sample X	2-ethylhexyl phosphate copper complex	neodymium acetate monohydrate	0.02	82.82	77.23	5.59

V. Study

Although, the blackening phenomenon was not observed in samples 1 to 11 according to the invention of the present application, the blackening phenomenon by a great number of fine black particulate spots was observed in Comparative sample X, in which neodymium acetate monohydrate was added as the metal salt compound.

Further, whereas the change in the visible ray transmittance by the irradiation of ultra violet rays are less than 5 % in all of the samples 1 to 11, the change in Comparative sample X using neodymium acetate monohydrate as the metal salt compound was as large as 5.59 %, it is apparent that a transparency of the sample was lowered by the blackening phenomenon.

(iv) From the results of the above mentioned comparative experiment, it is obvious that the metal salt compound of neodymium can not provide an effect of preventing the blackening phenomenon by the irradiation of ultra violet rays, and therefore, the other metal salt mentioned in Reference 2 does not necessarily show the operation and effect as the anti-blackening agent.

As described as above, the invention of the present application involves enough novelty and an inventive step over the invention mentioned in Reference 2 because the excellent effects are provided by utilizing the principle which is un-expectable from the technical matters mentioned in Reference 2 at all.

(2) Inventions according to Claims 5 and 6

Both inventions according to claims 5 and 6 of the present application depend on claim 1, and so have the same technical features as the invention according to claim 1. Therefore, the both inventions according to claims 5 and 6 of the present application involve a novelty and an inventive step over the inventions mentioned in Reference 1 and Reference 2.

(3) Invention according to claim 7

The invention according to claim 7 of the present application relates to the infrared-absorbing resin composition obtained by containing the infrared absorbent and the anti-blackening agent, which are mentioned in claim 1, in the resin component, and has the same technical features as the invention according to claim 1, and the same technical effects are achieved. Therefore, the invention according to claim 7 of the present application involves a novelty and an inventive step over the inventions mentioned in Reference 1 and Reference 2.

(4) Inventions according to claims 8 to 10, 14 and 15

All of the inventions according to claims 8 to 10, 14 and 15 of the present application depend on claim 7, and so have the same technical features as the invention according to claim 7. Therefore, the inventions involve a novelty and an inventive step over the inventions mentioned in Reference 1 and Reference 2, for the same reason.

[5] Conclusion

As described above, all of the inventions according to claims 1, 5 to 10, 14 and 15 are believed to involve a novelty and an inventive step in the relation with the inventions mentioned in Reference 1 and

Reference 2.

Therefore, reconsideration is respectfully requested so as to grant an opinion that the inventions according to claims 1, 5 to 10, 14 and 15 involve a novelty, an inventive step and an industrial applicability in an international preliminary examination report.